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The predictive value of HALP score and systemic immune inflammation (SII) index in patients with asthma

The role of HALP score in patients with asthma

Fatma Esra Günaydın
Department of Allergy and Immunology, Ordu University Training and Research Hospital, Ordu, Turkey

Abstract

Aim: Recent studies showed that the immune inflammatory response plays a significant role in patients with asthma. The objective of the current study is to examine whether hemoglobin, albumin, lymphocyte, and platelet (HALP) score and systemic inflammatory response index (SII) are effective in predicting asthma.

Material and Methods: In this retrospective case-control study, seventy patients diagnosed with asthma and 70 healthy subjects followed in the Allergy and Immunology Clinics of Ordu University Education and Research Hospital were included. The HALP score was calculated according to the following formula: HALP score = (hemoglobin (g/L) × albumin (g/L) × lymphocytes (/L))/platelets (/L). The SII index was calculated according to this formula SII (neutrophil x platelet/lymphocyte count).

Results: Neutrophil, lymphocyte , monocyte, mean platelet volume (MPV), CRP were statitically significant betweeen the groups ($p<0.05$, Table 2). However, there was no statistically significant difference between white blood cells and platelets. A statistically significant difference was found between SII, HALP score neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte (PLR) indices between the study groups ($p<0.05$).

Discussion: We indicated that SII and and HALP scores may be cost-effective and easily accessible biomarkers in predicting asthma and both could be used as treatment response markers.

Keywords

Iinflammation, Biomarker, Hemoglobin, Albumin, Lymphocyte, Platelet

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Corresponding Author: Fatma Esra Günaydın, Department of Allergy and Immunology, Ordu University Training and Research Hospital, Ordu, Turkey.
E-mail: fatmaesragunaydin@gmail.com P: +90 452 225 01 85 F: +90 452 226 52 35
Corresponding Author ORCID ID: https://orcid.org/0000-0002-9268-1071
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Introduction

Asthma is a chronic respiratory condition that affects the airways of the lungs [1]. It causes inflammation and narrowing of the airways, leading to symptoms such as wheezing, shortness of breath, cough, and chest tightness [2]. These symptoms can range from mild to severe and can vary in frequency. Inflammation is a central characteristic of asthma and plays a crucial role. The inflammation in asthma is chronic, which means that even when symptoms are not apparent, there is still ongoing inflammation within the airways. This chronic inflammation can result in long-term damage to the airway walls and lead to airway remodeling over time. Oxidative stress (OS) is a term used to describe an imbalance between the production of reactive oxygen species (ROS) and the body's ability to neutralize and detoxify these harmful molecules [3,4]. Oxidative damage usually can disrupt the cell function and contribute to the development of various diseases [5-9]. OS can amplify inflammation and contribute to chronic inflammatory conditions such as asthma and chronic obstructive pulmonary disease (COPD) [10].

The Systemic Inflammatory Index (SII) is a biomarker that has gained attention in medical research as a tool for assessing inflammation and its potential impact on various health conditions in several diseases [11-15]. The concept behind SII is that an increased SII indicates a higher level of inflammation and a potential imbalance in the body's immune response. The hemoglobin, albumin, lymphocyte, and platelet (HALP) score is often used as a prognostic or predictive tool, where deviations from normal ranges of these markers might suggest increased risk or severity of certain diseases [16]. It's important to note that while the HALP score can provide valuable insights, it is usually just one part of a larger diagnostic and prognostic evaluation [17]. The neutrophil-lymphocyte ratio (NLR) is often used as a marker of systemic inflammation and immune response in various medical conditions. The NLR can provide insights into the balance between the pro-inflammatory response (neutrophils) and the anti-inflammatory response (lymphocytes) in the body. An elevated NLR can suggest a shift towards inflammation and can be associated with various conditions, including infections and inflammatory diseases.

Recent studies have focused on the peripheral blood biomarkers because they are accessible, affordable, and widely used measurements. There is are a limited data on HALP score, SII and asthma. Since inflammation plays a significant role in the pathogenesis of asthma, the goal of our study was to compare hemogram parameters and novel inflammation indicators to the control group. This is the first report that evaluating the effectiveness of the HALP score and SII in predicting asthma.

Material and Methods

This retrospective study was conducted at the Ordu University, Education and Research Hospital, Department of Immunology and Allergic Diseases Outpatient Clinic from January 2023- to July 2023. A total of 70 patients with diagnosed with asthma and seventy healthy control subjects were included in this retrospective case-control study. There was no difference in age and gender between the two groups. The data of the study groups were collected from the hospital automation system. The current study was approved by the ethics committee of Ordu University (Date: 2023-07-07 / No: 2023/182). The study was conducted in accordance with the Helsinki Declaration rules.

Diagnosis of asthma

The diagnosis of asthma was based on the clinical history of variable characteristic symptoms (cough, chest tightness, shortness of breath and wheezing) and evidence of variable airway obstruction (<80 % forced expiratory volume in one second (FEV1) and FEV1/forced vital capacity (FVC) < 70% with an increase in FEV1 12% and 200 mL after 400 mcg of salbutamol and more than 10% diurnal peak expiratory rate (PEFR) variability for at least two weeks) [18].

Severity of asthma

According to inhaler medication use and level of treatment as specified by GINA, asthma severity was categorized as mild (steps 1-2 treatment), moderate (steps 3–4 treatment), or severe (steps 5 treatment) [18].

Exclusion criteria

The study exclusion criteria were as follows: aged < 18 years, exacerbation of asthma in the last one month, active neoplastic processes, diagnosed active viral or bacterial infection, atherosclerotic disease, diabetes mellitus, chronic kidney disease and elevated serum CRP/ erythrocyte sedimentation rate. The healthy group included in the study consisted of subjects who presented to the immunology and allergy outpatient clinic due to drug allergy and/or bee allergy without a history of additional allergic/systemic disease.

Parameters

The hemogram parameters, albumin and serum C-reactive protein (CRP) levels of individuals were obtained. Neutrophil -lymphocyte ratio (NLR), platelet- lymphocyte ratio (PLR), systemic inflammatory index (neutrophil x platelet / lymphocyte count) and HALP score (hemoglobin (g/L) × albumin (g/L) × lymphocytes (/L))/platelets (/L) were used in complete blood parameters.

Statistical analysis

SPPS 22 was used to carry out all data analysis. Data are were reported as median ± min-max. Whether the data showed normal distribution or not was determined by the Kolmogorov-Smirnov test. Variables that did not show normal distribution were compared with the Mann-Whitney U test. Categorical variables were compared with the chi-square test, and statistical significance was accepted as <0.05.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

The present study consisted of a total of 70 asthma subjects with an average age of 39.9 ± 14.2 and 70 healthy controls with an average age of 39.0 ± 12.7. There was no statistically significant difference between the groups in terms of age and gender (Table 1). According to the GINA guidelines, 41.4% of our patients had severe asthma.

The median (min-max) outcomes of the hemogram parameters and indexes between the groups are shown in Table 2.

Neutrophils, lymphocytes , monocytes, MPV, CRP were statistically significant betweeen the groups (p<0.05, Table

2). However, there was no statistically significant difference between WBC and Platelet. In addition, inflammatory indices were calculated for the study groups. A statistically significant difference was found between SII, HALP Score NLR and PLR indices between healthy individuals and asthmatics ((p<0.05) Table 2). There was no correlation was found between asthma severity and SII, HALP Score NLR and PLR.

Table 1. Demographic characteristics of the study groups.

Parameters		Asthma (n=70) mean ± SD	Control (n=70) mean ± SD	P
Gender	Male	25 (35.7 %)	32 (45.7%)	0.234*
	Female	45 (64.3%)	38 (54.3%)	
Age (year)		39.9 ± 14.3	39.0 ± 12.7	0.704¥

*Chi-Square test ¥ Student t –test

Table 2. Comparison of the blood parameters of the study and control groups

Parameters	Asthma (n=70) median (min-max)	Control (n=70) median (min-max)	P
WBC (10^3µL)	7.1 (4.5-10.9)	7.2 (4.4-10.3)	0.835
Neutrophil (10^3µL)	4.1 (1.5-7.9)	3.7 (2.4-6.9)	0.035
Lymphocyte (10^3µL)	2.1 (1.1- 3.2)	2.4 (1.2-3.9)	0.036
Monocyte (10^3µL)	0.53 (0.23-1.8)	0.47 (0.26-0.75)	0.018
Hemoglobin (g/dL)	13.6 (3.0-17.7)	13.2 (10.4-16.6)	0.133
Platelet (10^3µL)	261 (150-487)	256 (162-438)	0.845
Albumin (g/L)	44 (33.2-53.2)	46.3 (37.3-51.4)	0.002
MPV (fL)	10.2 (8.2-12.4)	9.3 (5.9-12.1)	<0.001
CRP (mg/L)	1.7 (0.3-8.6)	1.30 (0.13-15.0)	0.05
NLR	1.9 (0.57-5.6)	1.6 (0.85-3.4)	0.001
PLR	135.3 (70.5-359.6)	124.4 (60.5-204.8)	0.01
SII	595.0 (309.2-1380.6)	439.0 (230.1 -1036.2)	<0.001
HALP score	4.6 (0.9-10.1)	6.30 (3.6-9.8)	<0.001

*Mann- Whitney U test WBC: White Blood Cell; NLR: Neutrophil- Lymphocyte Ratio, CRP: C-reactive protein, MPV: Mean Platelet Volume, PLR: Platelet- Lymphocyte ratio, SII: Systemic inflammatory index (neutrophil x platelet / lymphocyte count).

Discussion

Asthma is a common disease characterized by chronic inflammation of the airways that effects children and adults [5]. Airway inflammation is the main part of asthma and basic clinical indices calculated from routine blood tests indicating that inflammation could be helpful for clinical management of asthma [(14)].

In this study, for the first time, NLR, PLR, SII and HALP Score indices were analysed together in healthy subjects with asthma. The aim of this study was to examine whether systemic inflammatory indices and HALP score play a crucial role in predicting the diagnosis of asthma. In this retrospective case-control study, we demonstrated that NLR, PLR, SII and HALP score levels were higher and statistically significant in patients with asthma compared to the healthy subjects (p<0.05). Moreover, we also evaluated hemogram parameters and neutrophil, lymphocyte, monocyte, values, which were found to be higher and statistically significant in the patient group compared to the control subjects (p<0.05). However, platelet levels were higher but not statistically significant in the patient group than healthy subjects.

However, it is unclear how CBC-derived indications are used to diagnose and predict asthma. Recently, Ke J et al. analyzed a total of 48,305 participants of the National Health and Nutrition Examination Survey (NHANES) and they found that the prevalence of asthma was positively associated with NLR, PLR, MLR, SIRI and SII [19]. In our study, the SII, NLR, PLR indices were also found to be different compared to healthy groups. Huang et al. indicated that the NLR levels are a reliable and simple-to-use marker for asthma and associated exacerbations, according to a meta-analysis [20]. Shi et al. demonstrated that NLR, a nonspecific inflammatory indicator, may accurately identify individuals experiencing an acute asthma episode and is correlated with the severity of the condition [21]. According to our findings, there was no relationship between severity and indices including NLR.

Erdal et al. [22] in their study in on patients with chronic spontaneous urticaria (CSU) they indicated that SII, NLR and PLR were higher in patients with CSU compared to the healthy subjects. They concluded that these indexes can be cheap, practical and safe indicators of inflammatory state in patientst with CSU. Similarly, we also evaluated the NLR, PLR and SII levels and found them statistically significant in patients with asthma than in healthy controls. We thought that these indices may help to understand and predict of inflammatory state in patients with asthma.

In the literature, Bayram et al. reported lower HALP score in patients with hyperemesis gravidarum compared to the healthy subjects. In addition, they also reported that they found the SII index value higher in the case group than in the healthy control subjects [23]. In line with the literature, we found that the SII index value is higher in patients with asthma compared to the healthy subjects. We hypothesized that the SII index can be used as a prognostic or predictive tool.

Tian et al. [24] reported that a high HALP score in patients with acute ischemic stroke was associated with a reduced risk of recurrent stroke and death within 3 months and 1 year. They concluded that there was a correlation between the HALP score and the risk of recurrent stroke and death within 90 days and 1 year. This suggested that the HALP score at admission may be a very strong indicator of recurrent stroke and death in patients with AIS. Another study conducted by Antar et al. [25] showed that patients with aged over 65 years, anemia treatment, kidney insufficiency, and cancer were independent risk factors associated with lower HALP scores in their study. Additionally, they also found higher HALP scores in male participants. In our study, the HALP score and SII index were found to be significantly higher in asthma patients compared to the control group (p<0.001). We hypothesized that the HALP score can be used as a prognostic and predictive tool in patients with asthma.

Conclusion

In conclusion, our study indicated that SII and HALP score is a new, cost- effective and practical inflammatory index that can be used in the evaluation of asthma patients. These indices can be an inexpensive, practical and safe indicator of the

inflammatory state in patients with asthma.

Limitations

This study also has several limitations. First of all, it included a small sample size. Secondly, phenotyping could not be performed due to technical limitations at the time of the study.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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